ABSTRACT

METHOD AND APPARATUS FOR THE MODULATION OF MULTILEVEL DATA ARRAYS

A method and apparatus for modulating multilevel data arrays to make them suitable for storage in multidimensional storage media, such as in holographic storage. In order to get a uniform signal of constant energy at the recording plane, first the multilevel data array, V_{out}, displayed on a spatial light modulator, has frequent transitions between symbols of different levels, and second it has constant energy. The energy is defined as the summation of the values of the symbols in the data array. The first constraint is achieved using $V'_{in} = V_{in} \oplus_q M(q, Z_O)$, where $\oplus_q$ stands for the modulo-q addition operation; $M(q, Zo)$ is a data array with randomly distributed symbols of q levels, where q is the number of levels and Z_O is the seed used to generate the random multilevel data array. In order to equalise the energy of the modulated data array V'_{in}, a q-ary balanced complementary method is used to complement the symbols of the input multilevel data array, V'_{in}, in a horizontal row-by-row readout order terminating after the first ii symbols. The final modulated output data array, $V_{out} = |C_{i,j} - V'_{in}|$, simultaneously satisfies both the constraints, where the elements of $C_{i,j}$ are (q-l)'s for the first ii elements in a horizontal row-by-row readout order, the others are O's.